

## CIVE/IPIS 5700: Blast Load Effects on Structures

### Course Outline – Winter 2024

COURSE INSTRUCTOR	COURSE SCHEDULE
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#### COURSE WEBSITE AND COMMUNICATION

All course information, assignments, and project files will be available through Brightspace. All students are responsible for ensuring that they are correctly registered through Brightspace and that they are receiving messages properly through their official university email address. Students are responsible for checking the Brightspace course management site and their official email account frequently. The announcement function in Brightspace will be used to send out any updates with important information related to the course.

#### COURSE DESCRIPTION AND OBJECTIVES

The primary objective of this course is to introduce students to the blast load (explosive) effects on infrastructures. It is expected that this course will bring into the mainstream blast hazards associated with explosions, be they accidental or man-made, and the methods available to mitigate their effects on civil engineering infrastructure. Among other things, the course will introduce the concepts of:

- Blast risk and vulnerability assessment.
- Blast load determination and design of structural components subjected to blast loading.
- Blast mitigation and retrofit design.

#### PREREQUISITES

This course is intended for graduate-level students with an existing background studying and/or practicing structural engineering. This course will also make references to Canadian and American design codes and standards; previous knowledge of these, while not required, is recommended.

#### COURSE TEXTBOOK

There are no assigned textbooks for the course. Class notes, handouts, and reference textbooks will provide students with sufficient information in regard to course material. These will be posted on Brightspace.

**COURSE DELIVERY AND PEDAGOGY**

*Lectures*

Lectures will take place during the official lecture times. Incomplete lecture slides (in PDF) will be posted the day before each lecture. Annotated “full” lecture notes will be posted following the end of the lecture, however, attendance to the lectures is **HEAVILY** recommended as not everything will be jotted down on the posted notes.

*Office Hours*

Office hours are specifically allocated by the instructor and the TAs (if assigned to the course) for you to ask questions and receive clarifications regarding course content. To get the most out of them, you are asked to prepare your questions and works-in-progress prior to attending.

*Course Project*

A requirement for the passing of this course will be to complete a term project. This will consist of conducting blast analysis and design of a high-profile structure located on Carleton University campus. The course project deliverables will consist of three written reports, to be handed throughout the term, as well as an oral presentation to be given to the class at the end of the term. Each project has to teach the class something novel and needs to demonstrate significant insight and understanding of the subject.

**TENTATIVE COURSE OUTLINE (SUBJECT TO CHANGE)**

Week	Lecture Date	Topic	Assignment	Project
1	10-Jan	Course Introduction		
2	17-Jan	Introduction to Explosives Discussion of Course Project		Groups formed Sites chosen
3	24-Jan	Effects of Explosions	A1 posted	Group duties report due
4	31-Jan	Blast Load Effects on Structures		
5	07-Feb	Introduction to Structural Dynamics	A1 due, A2 posted	
6	14-Feb	SDOF Analysis for Structural Members		Interim report due
7	N/A	Winter break, no lecture		
8	28-Feb	Behaviour of Materials under Blast Loads Introduction to the CSA S850	A2 due	
9	06-Mar	Design of Reinforced Concrete Elements	A3 posted	
10	13-Mar	Design of Steel Elements		
11	20-Mar	Design of Timber Elements	A3 due, A4 posted	
12	27-Mar	Incorporating Blast Testing with Design		
13	03-Apr	Project Presentations	A4 due	Presentations
14	N/A	No lecture		Final report due

**COURSE WORK AND ASSESSMENTS**

<p><b>Assignments</b>..... 25%</p> <p><b>Course Project</b> ..... 35%</p> <p><b>Final Exam</b> ..... 40%</p>	<ul style="list-style-type: none"> <li>▪ A final course grade of B- or better must be obtained in order to pass the course.</li> <li>▪ All components of the course must be fulfilled; otherwise, students may receive an F as a final mark. This is also valid for students who are taking the course for the second time.</li> <li>▪ A minimum grade of 50% on the final exam is required to pass the course.</li> </ul>
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*Assignments*

There will be a total of 4 assignments posted and due on the following dates:

Assignments	Posted Date	Due Date (11:59 pm)
Assignment 1 (A1)	Jan. 24	Feb. 7
Assignment 2 (A2)	Feb. 7	Feb. 28
Assignment 3 (A3)	Mar. 6	Mar. 20
Assignment 4 (A4)	Mar. 20	Apr. 3

A total of four (4) assignments will be given during the course. These will be due two (2) weeks after being posted on Brightspace. Due to the nature of this course, assignments may be written up using a word processing software, particularly when the assignment necessitates graphing and numerical solutions. Hand-written assignments are also accepted, given that they are legible and neat.

The assignments are to be submitted on Brightspace as a single PDF file. To the discretion of the course instructor, a grade of 0 may be attributed to poorly written assignments or those that were not submitted as a single PDF file. **No assignment solutions will be posted.** Feedback will be provided directly on the assignment. If desired, students are permitted to work on assignments in groups of two. Each group should submit one group assignment; don't submit your solutions individually.

*Course Project Deliverables*

There will be a total of 4 project deliverables due on the following dates:

Deliverables	Due Date (11:59 pm)
Group duties report	Jan. 26
Interim report	Feb. 16
Group presentation	Apr. 2
Final report	Apr. 10

*Final Exam*

The final exam has not yet been scheduled. You will be notified of the date, time and location through the university once SES makes the exam schedule available. The final exam will be an open-book exam.

## COURSE POLICIES

### *Appeals*

All appeals of grades assigned in this course must be made within 7 calendar days of the grade being made available. Note that an appeal may result in a reduction or an increase in grade.

### *Academic Integrity:*

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensure that a degree from Carleton University is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. Carleton University's Policy on Academic Integrity (<http://www.carleton.ca/studentaffairs/academic-integrity>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. It is your responsibility to be familiar with these policies. Any students who do not act with academic integrity will face severe consequences including immediate referral to Associate Dean of Student Affairs.

### *Email Policy*

The professor is more than happy to answer questions related to administration via email. **For course content questions, please use the office hours.** Effort will be made to reply to emails as soon as possible, but please expect a possible delay of up to 48 hours for a response. Emails will not be answered during weekends or holidays.

### *Missed Term Work*

Students who claim illness, injury, or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases. This must occur no later than three (3) days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. Consult [Section 4.4 of the University Calendar](#). In all cases, students must complete the *Self Declaration for Coursework* form hosted on the [Registrar's Office](#) website

If an absence or missed deadline is deemed justified:

- 1) Assignments: the weight of a justified missed assignment will be transferred onto the remaining assignments.
- 2) Final exam: Students who are unable to write the final examination because of a serious illness/emergency or other circumstance beyond their control may apply for accommodation by contacting the Registrar's office. Consult the Section 4.3 of the University Calendar. The student will need to submit the self-declaration form in addition to a deferral application ([carleton.ca/registrar/deferral](http://carleton.ca/registrar/deferral)) to the Registrar's Office no later than 3 days after the scheduled examination date.

### *Copyright*

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., are copyright protected and remain the intellectual property of the instructor. All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright

and remain the intellectual property of the instructor. Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s). Students are not permitted to upload these copyrighted course materials to any online repositories.

### *Learning and Working Environment*

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the [Department of Equity and Inclusive Communities](#) at [equity@carleton.ca](mailto:equity@carleton.ca).

We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone's personal beliefs, choices, and opinions.

### *Engineering Academic Advising*

[The Engineering Academic Support Service](#) assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation. Academic Advisors Contact can be found here: <https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/>

## **ACADEMIC ACCOMMODATIONS**

For an academic accommodation request, the processes are as follows:

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with learning disabilities, psychiatric/mental health disabilities, attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at **613-520-6608** or [pmc@carleton.ca](mailto:pmc@carleton.ca). You should request your academic accommodations in the [Ventus Student Portal](#), for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least two (2) weeks before the first test or midterm. For final exams, the deadlines to request accommodations are published in the [University academic calendars](#) for both undergraduate and graduate students.

**Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the [Senate Policy on Accommodation for Student Activities \(PDF\)](#).

**Pregnancy Obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation \(PDF\)](#).

**Religious Obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the [Student Guide to Academic Accommodation \(PDF\)](#).

**Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit the [Sexual Violence Prevention & Survivor Support](#).

## **PUBLIC HEALTH MEASURES**

**If you are feeling sick, please stay home.** If you require assistance due to missing a lecture while recovering from an illness, please contact a colleague or the course instructor. Remaining vigilant and not attending work or school when sick or with symptoms is critically important for the wellbeing of your peers and Carleton University staff. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. **In the event that the course instructor falls ill prior to a scheduled lecture, an announcement will be made on Brightspace and the in-person lecture will be canceled. A recorded lecture will be posted on Brightspace shortly afterwards.**

## **STUDENT MENTAL HEALTH AND WELLNESS**

University students may experience a range of mental health challenges that can significantly impact academic success and overall well-being. Carleton's Wellness Services Navigator is designed to help students connect with mental health and wellness resources. If a student needs to talk to someone from the department for more information and support with connecting to resources, they can contact the following faculty members, or contact the department at [CEEUGChair@cunet.carleton.ca](mailto:CEEUGChair@cunet.carleton.ca)

**ACSE:** Prof. [Scott Bucking](#) Office: 5209 Canal Building

**CIVE:** Prof. [Heng Khoo](#) Office: 3364 Mackenzie

**ENVE:** Prof. [Shoeleh Shams](#) Office: 4242 Mackenzie

The following is a non-exhaustive list of available on- and off-campus resources:

1. [Carleton's Wellness Desk](#): Located at 204A MacOdrum Library, is a space for students to learn about resources, connect with our Wellness Coordinator, and decompress during stressful times of the year. You can pop into the Wellness Desk any time during its hours of operation – no appointments necessary! <https://wellness.carleton.ca/mental-health/wellness-desk/>
2. [Carleton's Health and Counselling Services](#): To book an appointment contact the main clinic by calling (613) 520-6674. If urgent, let the Patient Care Coordinator know or go in person to the main

clinic (2500 Carleton Technology and Training Centre Building) and indicate that they are in crisis and need to speak to someone right away. <https://carleton.ca/health/>

3. [Emergencies and Crisis](#) and [Emergency Numbers](#)
  
4. [Good2Talk](#) (1-866-925-5454): Good2Talk is a free, confidential helpline providing professional counselling and information and referrals for mental health, addictions and well-being to post-secondary students in Ontario, 24/7/36 <https://good2talk.ca/>
  
5. [Empower Me](#): Undergraduate students have access to free counselling services in the community through Empower Me, either in person, by telephone, video-counselling or e-counselling. This free service is accessible 24/7, 365 days per year. Call 1-844-741-6389 (toll free) to make an appointment with a counsellor in the community. <https://students.carleton.ca/services/empower-me-counselling-services/>
  
6. [The Walk-In Counselling Clinic](#) (off-campus community resource): The walk-in Counselling Clinic have offices in various locations across Ottawa and the greater Champlain region that are open 7 days a week. Individuals will be assisted, with no appointment, on a first-come, first-serve basis during the Walk-in Counselling Clinic hours. The Walk-in Counselling Clinic offers services in many languages and is free and confidential. <https://walkincounselling.com/>
  
7. [Distress Centre of Ottawa and Region](#): Available 10am-11pm, 7 days/week, 365 days/year. Distress Line: 613-238-3311, Crisis Line: 613-722-6914 or 1-866-996-0991, Text: 343-306-5550. <https://www.dcottawa.on.ca/>
  
8. [Distress and Crisis Ontario](#), Available for chat 2 pm – 2 am EST. <https://www.dcontario.org/>
  
9. [BounceBack Ontario](#) (Toll-Free: 1-866-345-0224) is a free skill-building program managed by the Canadian Mental Health Association (CMHA). It is designed to help adults and youth 15+ manage low mood, mild to moderate depression and anxiety, stress or worry. Delivered over the phone with a coach and through online videos, you will get access to tools that will support you on your path to mental wellness. <https://bouncebackontario.ca/>.